ORIGINAL

BEFORE THE U.S. NUCLEAR REGULATORY COMMISSION

Petition by the State of Nevada Under Atomic Energy Act Section 274i and 10 C.F.R. § 63.63 for Financial Assistance in the Licensing Review of the Yucca Mountain Nuclear Waste Repository	)	**Docket No. _____**

I. Introduction

The NWPA contains elaborate provisions to ensure meaningful participation by Nevada in the Yucca Mountain nuclear waste repository program and in the Nuclear Regulatory Commission ("NRC") licensing proceeding for the repository. The NWPA describes state participation as "*essential* to promote public confidence" in the repository. 42 U.S.C. § 10131(a)(6)(emphasis added). A major purpose of the NWPA is thus to "define the relationship between the Federal Government and the State" with respect to nuclear waste disposal. 42 U.S.C. § 10131(b)(3). NWPA Section 117(a) prescribes participation by Nevada not only in site characterization activities, but also in review of "development, design, licensing, construction, operation, regulation . . . [and] decommissioning" of the repository. 42 U.S.C. § 10137(a).

Equally important, it was the judgment of Congress, as set out in the NWPA, that the costs of nuclear waste disposal "should be the responsibility of the generators and owners of such waste." 42 U.S.C. § 10131(a)(4). Congress provided that "the costs of carrying out activities related to the disposal of such waste and spent fuel will be borne by the persons responsible for generating such waste and spent fuel." 42 U.S.C. §10131(b)(4). NWPA Section 116(c)(4)(A)(iii) indicates that the federal funding for Nevada provided under the

addition, providing the support necessary for Nevada's world-class team of experts to accumulate reference materials prerequisite to their work ($500,000[1]).

B. Technical and Scientific Participation:

1. Climatology

Nevada will examine the approach taken by DOE to characterizing the future climate over the Yucca Mountain region over timescales ranging from 100 years to one million years after the present time.

This will include understanding DOE identification and application of:

- palaeoclimate proxies, especially the Devils Hole chronology and Owens Lake ostracode series, both relevant to the Yucca Mountain region;
- Milankovitch cycles and orbital forcing parameters;
- Climate model simulations of past, present and future climates;
- Observational data including the selection of analogue sites; and,
- Expert elicitation techniques.

DOE has commissioned a large body of research into climate change for the Yucca Mountain region. Although only a small proportion of this has been used in Performance Assessments, Nevada needs to identify and understand the full body of research. Methods to be investigated include those used to:

- identify future climate states;
- characterize the climate over the Yucca Mountain region during each climate state;
- generate future climate successions; and

[1] Figures in parenthesis at the end of each area of discussion represent Nevada's estimate of the amount of assistance needed and requested from NRC for FY2005.

- represent uncertainty.

An exploration will be made of spatial variability in climate over the region of interest, and whether the methods employed by DOE properly characterize this spatial variability. Nevada's climatology team will focus on the relationship between actual variability and the potential to characterize this using downscaling techniques based on model and observed data ($400,000).

2. Geology, Volcanism, and Seismicity

Nevada will study issues related to the geology of the Yucca Mountain site, volcanic hazard and consequence, and seismic hazards. Specifically, Nevada will:

- Provide alternative calculations of the probability of volcanic disruption of the Yucca Mountain repository.
- Evaluate the importance of the buried volcanic centers to probability calculations. The recognition of the buried centers changes volcanic recurrence rates and the overall size of the volcanic field. If recurrence rates reach 17-20/million years and the numbers of centers increases to 25-30, the Yucca Mountain area would prove to be one of the largest volcanic fields in the Basin and Range.
- Evaluate alternative petrogenetic models for the evolution of basalt magmas in the Yucca Mountain that consider the deep melting concept and the presence of a mantle melting anomaly. If these models are correct, then a new cycle of volcanic activity is possible in the next 10,000 years.
- Consider the effects on volcanic probability calculations of extending the compliance period to peak dose (200,000 to 1 million years).

- Evaluate the effects of volcanic ash injection into the biosphere, and consider the effects of ash on short term and long term climate, and radioactive ash accumulating in soil and dunes in the vicinity of the repository.
- Evaluate the effects of a dike or eruption occurring near the repository. This near miss scenario includes changes in ground water flow paths, rock alteration and thermal effects related to dike emplacement. Evaluate the mechanics and probability of fault activation (or re-activation) by dike emplacement.
- Evaluate tectonic models for the formation of Crater Flat, Bare Mountain and Yucca Mountain.
- Examine the evidence for Holocene faulting in the Yucca Mountain area.
- Assess seismic hazard studies for Yucca Mountain.
- Examine extremely large motion, low probability seismic events and questions created if the compliance period is extended.
- Examine smaller motion events with magnitudes up to 7 to 7.5 and their effects on repository and surface facilities for post- and pre-closure periods.
- Determine the cumulative effects of intermediate ground motions ($500,000).

3. Design, Engineering, Pre-closure Performance, and Criticality

The DOE approach to criticality safety assessment will be carefully reviewed in respect to waste storage on site prior to emplacement, the emplacement process, the period after emplacement during which the repository remains open, and the long-term (to approximately 1 x 10^6 years after present) following closure of the repository. For the long-term, particular attention will be given to the possibility of criticality events within the first 1 x 10^4 years.

- For the waste storage period and emplacement process, particular consideration will be given to external events, e.g. aircraft impact, seismic shocks and drop accidents, that have the potential to disrupt storage casks/disposal packages, taking into account the potential for introduction of moderator either at the time or subsequently.
- For the period after emplacement when the repository remains open, consideration will be given to external events, e.g. rock fall, and corrosive penetration of the storage containers. Over this period, it is likely that the emphasis will be on the potential for in-container criticality.
- For the period after closure, while external events will continue to be considered, the emphasis will be on corrosive penetration of the canisters, the distribution of water as moderator within and around them, the differential movement and chemical mobilization of neutron poisons and fissile isotopes and the potential for both in-canister and ex-canister criticality events.
- The evaluation will include, but will not be restricted to:
    - The comprehensiveness of the identified classes of criticality events;
    - The techniques used to assess the likelihood or frequency of the various classes of events, including evaluation of fault and event tree approaches, and hydrogeochemical modeling;
    - The techniques used to define geometrical and compositional configurations of interest;
    - The adequacy of the methods used to determine the k_{eff} of those geometrical and compositional configurations;

- The adequacy of the methods used to determine reactivity insertions and the yield of both brief and protracted criticality events.

- Nevada will evaluate the implications of criticality events for system performance, including potential implications for repository operability and completion during the storage, emplacement and operational phases, and implications for radiological impact in the post-closure phase ($500,000).

4. Evolution of the Engineered System and Perturbed Near Field

Nevada will continue its in-depth evaluation of the engineered barrier system ("EBS") performance in the subsurface of the proposed repository. It will concentrate on the design of the EBS with respect to the corrosion of its components and the lifetime prediction of its performance within the anticipated in-drift service environments through the regulatory period.

Nevada's corrosion group will focus upon the assessment of the technical basis for predicting the performance in the near-field, in-drift, and in-package environments. It will be concerned with a wide range of issues dealing with the complexity of the dynamic environment and the associated behavior of the key metallic components within this system. These issues include, but are not limited to, the metallurgy of the manmade components, heat-to-heat effects of the materials, geometry of the EBS materials with respect to corrosion, dust, rock fall, the chemistry of the liquid and vapor phases in the near-field, in-drift, and in-package environments, the transient temperatures in the environment, neomineralization, rock-water interaction, microbiological effects, corrosion, dissolution, and radiolysis.

Among the specific areas of investigation upon which Nevada will focus, relative to the performance of the EBS are:

- vadose zone pore waters: variation by rock type, structural feature and locations;

- microbial metabolic chemical effects on infiltrating and refluxing waters;
- waters of infiltration: composition (including trace elements), amount, flux, and variations with climate regime;
- deposition of evaporation salts in transport pathways;
- seepage waters: composition, amount and evolution on hot metallic surfaces;
- dust: amount, mineralogical composition, size distribution, and variation with time;
- deliquescence: use of binary salt versus ternary and higher component systems;
- relative humidity: variation with time, location, and temperature;
- corrosion of EBS: drip shield, canister (C-22 and stainless), canister supports, track, etc.;
- stability of welds;
- variations caused by non-uniformity of material compositions;
- types of corrosion for C-22 and welds and for Titanium-7 drip shield (stress corrosion cracking, general corrosion, localized corrosion, and microbially induced corrosion);
- evolution of evaporitic water and salts on hot metallic surfaces;
- role of drift wall rock and invert rock in modulating the pH of drift water;
- radiolysis effects: changes to in-drift water chemistry;
- thermal effects;
- composition amounts in evolution of waters entering containers;
- formation and circulation of acidic vapors;
- corrosion of internal components;

- spacers, cladding, and absorbers;
- alteration/dissolution of spent nuclear fuel; and
- issues related to near-field, in-drift, and in-package environments if the regulations were to be extended beyond 10,000 years ($1,800,000).

5. Hydrology, Hydrogeology, and Hydrochemistry

Nevada will focus on the analysis and modeling of flow processes at Yucca Mountain, specifically net infiltration, unsaturated zone flow and saturated zone flow, together with the use of hydrochemistry in the interpretation of fluxes and travel times.

Net infiltration assessment will include the use of observed and modeled climate data as input to hydrological simulation tools for performance assessment.

Unsaturated zone issues will include flow processes in the natural system, and the effect of the proposed repository on unsaturated flow, including seepage into the drifts, the impacts of heating, and flow paths below the repository to groundwater.

Saturated zone issues will focus on groundwater flow processes and travel times throughout the impacted groundwater system to the biosphere (i.e. not simply the 18km boundary), including potential impacts of volcanic/seismic disturbance.

This team will need to consider effects of climate change, and the representation of uncertainty in the Total System Performance Assessment ("TSPA") and will undertake close coordination of effort and findings with the Radionuclide Transport from Wastes to Biosphere, since the representation of flow processes is central to transport assessments ($800,000).

6. Radionuclide Transport from Waste to Biosphere

Nevada's radionuclide transport group will focus on the key elements for the transport of radionuclides from waste to biosphere, namely:

- The release of the radionuclides from the waste forms.

- The migration of the radionuclides through the engineered system and the disturbed zone around the vaults.
- The migration of radionuclides though the unsaturated zone:
    - Recognizing the close link to and the inputs from the Hydrology team.
- The migration of radionuclides though the saturated zone:
    - Again recognizing the close link to and the inputs from the Hydrology team.
- Retardation processes, such as sorption and diffusion into the rock matrix, and also dispersion processes (including issues such as whether, for example, geochemical information can build confidence in (or undermine) the travel times of the non-sorbed radionuclides, such as 99Tc, and sorbed radionuclides, such as 237Np).

Key questions to be considered include:

- Whether the data adopted by DOE are justified – including sorption data and data on leaching from the waste. There are two separate threads to this question:
    - Whether the data utilized by DOE are relevant and based on defensible experiments.
    - Whether the parameters used in the models are based on suitable data.
- Whether the treatments of uncertainties and variabilities are justified.
- Whether the conceptual models are justified and whether there are viable alternative conceptual models that have not been considered.
- Whether any features, events, or processes have been forgotten or neglected.
- Whether DOE's view of system evolution is justified.

- Whether DOE's mathematical models can be relied upon with confidence.
- Whether DOE's numerical models are reasonable representations of the mathematical models.
- Whether DOE has extrapolated anything unreasonably.
- Whether DOE has upscaled anything unreasonably.
- Whether DOE has simplified the models reasonably in the PA.
- Whether DOE's understanding of radionuclide transport is reasonable and correct.

It is important to an understanding of radionuclide transport to recognize that transport in the saturated zone has been studied widely in a number of contexts, whereas transport in the unsaturated zone is a far less well-understood system, particularly over the length scales relevant to Yucca Mountain ($500,000).

7. Site Description and Biosphere Modeling

The characteristics of the biosphere to be used in post-closure radiological performance assessments of the proposed radioactive waste repository at Yucca Mountain are strongly constrained by the rules promulgated by the Environmental Protection Agency ("EPA") and NRC. Themain emphasis of the review will be on whether DOE has undertaken a comprehensive and appropriate biosphere assessment within the context of the rules and in the light of international practice in this area. This review will include, but will not be restricted to:

- The comprehensiveness of the underlying FEP (Features, Events and Processes) analysis, including consideration of whether all relevant FEPs have been identified and characterized at a suitable level of detail, whether interactions between FEPs have been analyzed using an appropriately structured methodology, and whether screening of FEPs has been appropriately

undertaken, both in respect of the first 1 x 10^4 years after repository closure and in the longer term, to the time of peak dose (around 2 x 10^5 to 1 x 10^6 years after repository closure);

- The adequacy of the conceptual model of the biosphere adopted by DOE, including consideration of whether all relevant exposure pathways have been included and taking potential environmental change into account;
- The appropriateness of DOE's assumptions concerning human habits and behavior that have been adopted (bearing in mind the constraints imposed by the EPA and NRC rules);
- The adequacy of DOE's implementation of the conceptual model as a mathematical model;
- The adequacy of the database of parameter values used in conjunction with that model, including consideration of the degree to which those data values are founded on comprehensive reviews of the available literature or the deployment of expert judgment;
- Whether there are deficiencies in the approach and data that could have properly been reduced or eliminated by field or experimental studies, if those had been undertaken in a timely manner and in cognizance of the state of the science at the time that those studies would have to have been undertaken; and
- Whether results obtained from the model have been reported in a way that is suitable for use in radiological performance assessments, revealing clearly the issues arising that are relevant to safety ($400,000).

8. Overall Performance Assessment Issues and TSPA Support

Nevada will undertake the examination of Overall Performance Assessment Issues and TSPA Support, including:

- Review of the overall scope of the post-closure radiological performance assessment submitted by DOE in respect of Yucca Mountain to determine whether there are deficiencies with respect to comprehensiveness and adequacy of argument; and
- Evaluation of whether the post-closure radiological performance assessment submitted by DOE with respect to Yucca Mountain is adequate to underpin the safety case for disposal of spent nuclear fuel and other high level radioactive wastes.

In support of this effort, detailed top-down reviews will be undertaken of the performance assessment documents submitted in support of the LA by DOE. In addition, reviews will be undertaken of responses to those documents and the LA by interested parties, including, but not limited to, the NRC.

In support of these review activities, Nevada will acquire, install, review, modify as appropriate, run and evaluate output from the version of TSPA model used by DOE in support of its LA. This will require familiarization both with the GoldSim simulation package in which the TSPA model is implemented and with the TSPA model itself. In addition, Nevada's TSPA team will acquire, install, review, modify as appropriate, run and evaluate output from the version of the Total-System Performance Assessment ("TPA") model used by the NRC as a support tool in evaluating submissions from DOE.

Nevada will also acquire, install, review, modify as appropriate, run and evaluate output from other overall performance assessment models relevant to Yucca Mountain, e.g. the model

developed by Electric Power Research Institute ("EPRI"), in so far as the use of such models is helpful in evaluating the adequacy of DOE's LA.

Nevada's TSPA team will advise its other specialist teams as to how their particular areas of expertise are described in the overall performance assessment and how those areas of expertise are represented in the various overall performance assessment models, with an emphasis on the DOE TSPA model. In modifying the overall performance assessment models and in selecting input data sets for variant calculations, Nevada's TSPA team will take advice from the various specialist teams with respect to their particular areas of expertise and interfaces between those areas of expertise. It is anticipated that these interface issues will map closely onto the interfaces between modules in the overall performance assessment models.

Nevada's TSPA team will advise the specialist teams of priority areas for review and modeling as determined by their significance in the overall performance assessment and relevance to the overall safety case for the facility. It will also evaluate whether DOE has performed model abstraction on these process models in such a way that the abstracted models are fit-for-purpose in the context of the overall performance assessment.

Nevada's TSPA team will keep track of any changes to the EPA and NRC rules relating to Yucca Mountain under review and will advise the specialist teams, legal team and representatives of Nevada of the implications of any such rule changes for performance assessment and the overall safety case.

In all its activities, Nevada's TSPA team will have due regard to the state of the art in post-closure radiological performance assessment internationally, both with respect to the criteria and standards adopted, and in terms of the methodologies used.

The preparation and evaluation of such a TSPA involves an array of complicated, highly scientific and technical issues, requiring the talents of a body of experts from diverse

disciplines. The TSPA includes over 5,000 parameters, and over 7,000 mathematical models. The TSPA is so complex, and the uncertainties so large, that a full calculation (computer run) must be repeated some 300 times in order for the statistical significance of the results to be evaluated ($2,000,000).

9. Expert Elicitation

Nearly every aspect of DOE's site characterization and performance assessment for Yucca Mountain involved significant uncertainties. The primary method to evaluate, and perhaps reduce, these uncertainties should be collection of sufficient data and information during site characterization. However, factors apparently made it necessary for DOE to complement and supplement the data obtained during site characterization with the interpretations and subjective judgments of technical experts. Thus, expert judgments, formally and informally elicited, will be used by DOE in its attempted demonstrations of compliance with NRC's geologic disposal regulation.

Since 1990, the Nuclear Waste Technical Review Board ("NWTRB") and the National Academy of Sciences ("NAS") have also addressed DOE's plans to use expert judgment. Both the NWTRB and the NAS, independently, have expressed concerns with these plans and, in particular, with how DOE addresses the potential for "bias" and "conflicts of interest" when conducting expert elicitation.

Expert elicitation is a *formal*, highly structured, and well-documented process whereby expert judgments, usually of multiple experts, are obtained. Formal expert elicitations usually involve *normative experts, generalists,* and *subject-matter experts*.

NRC has implemented a Branch Technical Position ("BTP") to: (1) provide general guidelines on those circumstances that may warrant the use of expert elicitation; and (2)

describe acceptable procedures for conducting expert elicitation when it is used to support a demonstration of compliance with NRC's geologic repository disposal regulations.

If conducted optimally, formal elicitation can reveal a wide range of scientific and technical interpretations, thereby exposing the uncertainties in estimates concerning repository siting, design, and performance attributable to limitations in the state of technical knowledge.

Nevada intends to retain an expert on the scientific method and probabilistic/statistical analysis to review each of DOE's expert elicitations to determine whether there is a proper scientific basis for them, whether the NRC process for expert elicitation was appropriately followed, whether there is readily available read data that might have been available to modest additional cost and effort instead of relying on the elicitations, whether judgments in elicitations were appropriately aggregated, whether the elicitations were made on the basis of sufficient and correct foundational data, and whether the elicitations effectively constitute junk science or are reasonable approximations of reality. ($250,000)

10. Quality Assurance

Quality assurance includes all the planned and systematic actions necessary to provide adequate confidence that the geologic repository will perform safely and satisfactorily in service. This is one of DOE's most important obligations, both in practice and in planning, and is a key facet of its LA, one which Nevada will pay particular attention to evaluating.

First, DOE must establish qualification or requalification of all samples, experiments, tests, analyses, calculations, assumptions, and parameters that were originally acquired, performed, or implemented under circumstances lacking appropriate quality assurance tools, methods, and procedures. As promised by DOE correspondence of December 24, 2002, from Joseph D. Ziegler to Janet R. Schlueter (Chief, NRC's High-Level Waste Branch), "If any of the pre-LA results cannot be determined to be consistent with analyses conducted under full

quality assurance ("QA") controls for the LA, a revised approach to resolution will be developed for each impacted KTI agreement item."

Second, DOE must establish its preparedness to fully comply with the requirements of 10 C.F.R. 63 Subpart G as follows:

- DOE must establish and execute a comprehensive quality assurance program.
- DOE is required by Sec. 63.21(c)(20) to include in its Safety Analysis Report a description of the quality assurance program to be applied to all structures, systems, and components important to safety, to design and characterization of barriers important to waste isolation, and to related activities.
- The description must indicate how the applicable quality assurance requirements will be satisfied.
- High-level waste repositories include structures, systems, and components that prevent or mitigate the consequences of postulated event sequences or that are important to waste isolation capabilities that could cause undue risk to the health and safety of the public. The pertinent requirements of this subpart apply to all activities that are important to waste isolation and important to safety functions of those structures, systems, and components. These activities include designing, purchasing, fabricating, handling, shipping, storing, cleaning, erecting, installing, inspecting, testing, operating, maintaining, repairing, modifying, site characterization, performance confirmation, permanent closure, decontamination, and dismantling of surface facilities.
- DOE's quality assurance program must be documented by written policies, procedures, or instructions and must be carried out throughout facility life in accordance with those policies, procedures, or instructions.

- DOE must establish measures to assure that applicable regulatory requirements and the design basis, as defined in Sec. 63.2 and as specified in the License Application, for those structures, systems, and components to which this subpart applies, are correctly translated into specifications, drawings, procedures, and instructions. These measures must assure that appropriate quality standards are specified.
- DOE must establish measures to assure that applicable regulatory requirements to assure adequate quality are suitably included or referenced in the documents for procurement of material, equipment, and services.
- Activities affecting quality must be prescribed by documented instructions, procedures, or drawings of a type appropriate to the circumstances and must be accomplished in accordance with these instructions, procedures, or drawings.
- DOE must establish measures to control the issuance of documents, such as instructions, procedures, and drawings, including changes to them that prescribe all activities affecting quality.
- DOE must establish measures to assure that purchased material, equipment, and services conform to the procurement documents.
- Measures must be established for the identification and control of materials, parts, and components.
- DOE must establish measures to assure that special processes, including welding, heat treating, and nondestructive testing, are controlled and accomplished by qualified personnel using qualified procedures.

- DOE must establish and execute a program for inspection of activities affecting quality to verify conformance with the documented instructions, procedures, and drawings.
- DOE must establish a test program to assure that all testing required to demonstrate that structures, systems, and components important to safety will perform satisfactorily in service is identified.
- DOE must establish measures to control the handling, storage, shipping, cleaning and preservation of material and equipment in accordance with work and inspection instructions to prevent damage or deterioration.
- DOE must establish measures to indicate the status of inspections and tests performed on individual items of the high-level waste repository.
- DOE must establish measures to control materials, parts, or components which do not conform to requirements in order to prevent their inadvertent use or installation.
- DOE must establish measures to assure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and non-conformances are promptly identified and corrected.
- DOE must maintain sufficient records to furnish evidence of activities affecting quality.
- DOE must carry out a comprehensive system of planned and periodic audits to verify compliance with all aspects of the quality assurance program and to determine the effectiveness of the program.

- Nevada will assess the capability and adequacy of DOE's planning and implementation, and its documentation, each of these responsibilities. Nevada plans to retain a quality assurance expert to, among other things, conduct a vertical slice review of specific performance modules used by DOE as foundational information for its performance assessment ($250,000).

11. Aircraft Crash Analyses

Nevada will undertake an assessment of the aircraft hazards associated with the proposed repository facilities, both from the point of view of the probability and the consequences of such hazards. Nevada believes that DOE's analysis of this hazard to date is substantially flawed, with unsupportable assumptions being employed which have the effect (and perhaps the calculated effect) of resulting in a calculation of the probability of this hazard being below the threshold necessary for DOE to assess its consequences.

By way of example only, DOE's flawed analysis assumes that aircraft will be within their designated airspace when an accident sequence initiates: no allowance is made for human error, due to which aircraft may already be well outside its designated airspace when an accident sequence initiates, and indeed, the deviation from a planned route may be the cause of a crash in mountainous terrain. In this regard, Nevada may undertake an analysis of actual civilian and military flight paths compared with planned flight paths, with an emphasis on variations that took the aircraft outside designated airspace.

In another example, the physical area which DOE uses in its calculation for the potential impact area relating to the Yucca Mountain facility was a very small one, addressing the aboveground fuel handling facilities at Yucca. But the NWPA requires DOE to have the ability to retrieve whatever amount of waste has been emplaced, for a long period of time. At a point in time where most of the waste has been emplaced, if it had to be retrieved, there would

be an enormous area on the surface required for storage pads for such retrieved waste. DOE did not even consider this enormous area when assessing the possible damage caused by aircraft crash. The actual area which should have been under consideration, assuming retrievability, would be many multiples of the area considered by DOE.

Yet another example is DOE's assumption that take-offs and landings from a particular busy airport would increase by five percent a year from the current 60,000 to a total of 440,000 per year at a future date. DOE totally failed to consider the concomitant increase in likelihood of collisions and near misses that would result from the air being so filled with aircraft (more than a seven-fold increase in traffic, under DOE's projection).

Nevada observes that once self-targeting ordnance fails to locate its correct target, it has the potential to travel a very considerable distance before impacting. Nevada may accordingly assess the number of air-to-ground ordnance deployed per year and estimate the probability of impact at different distances from the boundaries of the assumed safety footprint. Such ordnance may be designed to penetrate reinforced targets or deep into the ground, and so, the effects of such ordnance impacting on aboveground facilities could be severe.

DOE "screened out" from consideration, in its calculation of frequency, crashes at low altitude and low speed, assuming these would not bring about material damage. This and other assumptions are disputed by Nevada, which believes evidence will support contrary assumptions and will likely discredit DOE's final "frequency" analysis to the point where a "consequence" analysis will be necessary, one which Nevada will likewise undertake. DOE's final calculation resulted in the conclusion that "by a factor of two" the probability of a crash did not reach the threshold requiring consequence analysis. The correction of even one or a few of DOE's multiple, "stacked," insupportable assumptions would be sufficient to result in a "frequency" analysis mandating a concomitant "consequence" analysis.

As in any aircraft crash hazard analysis, one involving a potential repository at Yucca Mountain would involve the accumulation and analysis by engaged experts of an enormous quantity of factual data relating to numbers and types of aircraft flying in the vicinity, potential causes of crashes, calculation of glide paths, speeds at impact, and innumerable other details. This would include hazards associated with small military aircraft, large military aircraft, DOE aircraft, dropped objects (including ordnance), and civilian aircraft. Calculations would have to be made with respect to crash rate, impact area, plane or helicopter crashes, flight frequencies and flight paths from military, DOE, and civilian airports within reach of Yucca, with particular attention to aircraft hazards engendered by the highly mountainous terrain in the area of the proposed Yucca facility. In view of the fact that DOE apparently intends to "screen out" the eventuality of aircraft crashes from its assessment of a potential Yucca Mountain site, it becomes essential for Nevada to undertake a realistic and competent aircraft crash hazard frequency and consequence assessment ($250,000).

12. Analysis of DOE Final Environmental Impact Statement

Under the NWPA, NRC may adopt DOE's Yucca Mountain Final Environmental Impact Statement ("FEIS") "to the extent practicable." Nevada found numerous foundational and substantive flaws in DOE's FEIS, released on February 14, 2002. Although Nevada filed a lawsuit challenging these errors under the National Environmental Policy Act and closely related provisions of the NWPA, the Court of Appeals for the D.C. Circuit may decide, based on indications in oral argument at which NRC was present and rendered views, that Nevada's challenge to the FEIS was mooted by Congressional passage of the joint resolution that approved Yucca Mountain as the proposed repository site. However, the Court seemed to believe, and secured views from the Department of Justice and from NRC agreeing, that Nevada remains free to challenge the substantive defects in the FEIS during NRC licensing

proceedings or upon any final agency action by DOE, such as on a supplement, postdating the joint resolution. Accordingly, Nevada plans to develop numerous contentions based on the FEIS and on DOE's transportation-related supplement and any other supplements. These will include, *inter alia,* contention's on DOE's flawed "no action" alternative; on DOE's refusal to consider the implications of the Resource Conservation and Recovery Act ("RCRA") on repository viability and licensing; on DOE's refusal to consider federal statutory prohibitions in Nevada on a multiple retrievable storage system DOE plans to accompany the repository; on illegal segmentation of the project's transportation component; and on gross failures in project definition. ($250,000)

13. NEPA and Transportation

Nevada will analyze and present through factual evidence and expert testimony at the licensing proceeding proof that DOE's key transportation decisions are both irrational and insupportable. DOE has failed to plan for the transportation of spent nuclear fuel and high-level radioactive waste to the proposed repository site in a comprehensive and integrative fashion.

- While DOE has indicated its preference for the so-called Caliente Corridor for transportation of waste within Nevada, neither DOE's FEIS nor any other document contains a legally and substantively adequate analysis comparing the various rail spur options and justifying the identification of Caliente as the preferred alternative. DOE made this identification before it had adopted a preferred transportation mode, and before any national rail routing work had been produced.
- DOE ought to have developed a national transportation plan describing a proposed action and alternatives, including a local Nevada state component that

is consistent with the national plan and which would become the basis for a formal NEPA scoping process. DOE should then have prepared a draft EIS assessing the impacts for the national system for the proposed and alternative actions respecting the national system and the Nevada system.

- Nevada will present contrary analysis and conclusions with respect to many aspects of DOE's FEIS as it relates to transportation, its selection of the "mostly rail" mode, and its preference of the Caliente corridor.
- Nevada will address DOE's last-minute legally insupportable effort to change horses in midstream by issuing a "Supplement Analysis" concluding it need not prepare a supplemental FEIS, and yet embracing a mode of transportation (light-truck casks on railroad cars) which was summarily rejected in its FEIS.
- Nevada's transportation team will analyze realistic sabotage/terrorist threats and the risk of criticality during transportation, all of which have been neglected by DOE in its formulation.
- Nevada will address the impact upon transportation planning of Nevada's mountainous terrain, as well as Native American interests, ranching operations (on November 8, 2003, DOE published its strategic plan for transportation, promising "we will conduct a thorough, open and collaborative planning process with interested parties . . ."; to this day, ranchers in the now-designated Caliente corridor have yet to hear so much as a word from DOE), potential severe accidents (the risks of collision and derailment exist at every point within the system, and especially within the rail yards of major cities), terrorism, and sabotage.

Among the transportation planning components which Nevada will evaluate are:

- Selection of transportation routes and modes;
- Emergency response planning and training;
- Safeguards and security;
- Operational practices;
- Communications and information access;
- Waste packaging for transportation; and
- Worker protection, training, training standards, and qualifications ($600,000).

C. Legal participation

The licensing proceeding which the NWPA requires DOE to pursue for this first-of-a-kind facility will be intensive and thorough and will involve an enormous number of adversarial contentions, discovery, motion practice, and evidentiary hearings, as well as travel expenses. Nevada must employ counsel with the specialized legal training and experience prerequisite to competently and thoroughly prepare for and conduct Nevada's participation in the licensing proceeding. As recently as March 24, 2004, by way of comparison, DOE awarded a contract to the law firm of Hunton & Williams providing for a budget of over $12 million for the remainder of 2004 and a total of over $45 million over a five-year period, with option years bringing the cost of DOE's anticipated legal services to some $63 million. (This is strictly legal fees and does not include expert witness fees). We understand that NRC is also hiring up to a dozen new attorneys to assist it with the Yucca licensing proceeding. The last three major NRC licensing proceedings, each far smaller than the licensing proceedings for the Yucca Mountain repository, involved many tens of millions of dollars for legal and expert witness fees alone.